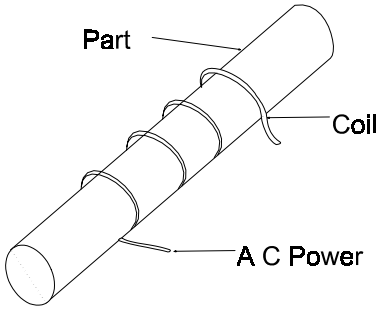
Applied Technology: Induction



Source: Bobart Associates

Concept

Induction heating uses an electromagnetic field that is generated via an inductor coil. The magnetic field is produced by applying an AC current with a frequency of 60 Hz to 800 kHz into the inductor coil. The magnetic field intersects the workpiece generating a circulating current. The resistance of the workpiece to this current generates heat. Shallow heating for surface applications such as case hardening can be obtained with medium to high frequencies. Deeper or through heating applications such as hot metal working is achieved at lower frequencies. Various types of inductor coils can be designed to heat any conductive material placed within, outside, or along side the inductor coil.

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Applications

- Melting
- Heating
- Heat Treating
- Welding, Brazing, Soldering, and Bonding
- Curing of coatings
- Conductive Susceptor or Metal Interface: heat non-conductive materials
- Electromagnetic Stirring and Casting
- Levitation Melting

Technologies Replaced

- Fossil/Electric Furnace Heating
- Salt/Lead Bath Heat Treating
- Flame Heat Treating

Wastes Reduced

- Combustion Pollutants; ROG, SO_X, NO_X,CO_X, Particulate
- VOCs (in curing powder coating)
- Material Oxidation; slag, scale
- Salt/Lead Bath; hazardous salts/metals

Potential in Manufacturing

Indust	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*	*Indust*	*SIC*	*Pot*
Food	20	LOW	Lumber	24	LOW	Chem	28	MED	Stone	32	MED	**Elect**	**36**	**HI**
Tobac	21	LOW	Furn	25	MED	Petrol	29	LOW	**Pmetal**	**33**	**HI**	**Transp**	**37**	**HI**
Textile	22	MED	Paper	26	LOW	Rubber	30	MED	**MetFab**	**34**	**HI**	Instr	38	MED
Apparel	23	LOW	Printing	27	LOW	Leather	31	LOW	**Mach**	**35**	**HI**	Misc	39	MED

Credits: George Bobart, Bobart Associates; Unimar Group, Ltd; The Electrification Council; Electric Power Research Institute

Induction *continued*

Technology Advantages

- Fast, efficient, highly controllable heating
- High level of productivity
- Reduced wastes
- Overall reduced operating costs
- High quality

Technology Disadvantages

- High capital cost for low volume applications
- Part must be conductive
- Inflexible for production of wide range of sizes and shapes

Typical Costs

Capital Costs	O & M Costs	Potential Payback
$25,000 - $1,000,000 depending on size and application	low maintenance, costs usually lower than alternative fuels due to greater efficiency	about a year

Installations

Case A - A major hand tool manufacturer in the Midwest installed an induction heating system to replace a process that hardened hammers in a salt bath then tempered them in a gas fired furnace. The induction system used a rotary table to automatically harden and temper both the head and claw areas of the hammer. This system provided a 50% reduction in energy costs and a 40% increase in productivity. It also reduced rejects by 20%, improved safety, and eliminated all of the hazardous wastes.

Case B - An aftermarket automotive supplier was hardening valves with an aluminizing process. But higher compression engines required improved hardening properties and environmental regulations were increasing the cost of properly handling the aluminum waste stream. The company replaced the aluminizing process with an in-line induction hardening system. The induction system met all process performance requirements for use in high compression engines, eliminated the aluminum sludge waste stream, reduced energy costs by 20%, and improved productivity by 25%.

Major Vendors

Induction

Abar-Ipsen Industries
3260 Tillman Drive
Bensalem, PA 19020
(215) 244-4900 (in PA)
(800) 374-7736 (outside PA)

ABB Metallurgy, Inc.
Induction Furnace Division
North Brunswick, NJ 08902
(908) 932-6134

Ajax Magnethermic Corp.
1745 Overland Ave
Warren, OH 44482
(216) 372-8511

American Induction Heating Corporation
33842 James J. Pompo Drive
Fraser, MI 48026
(810) 294-1700

Cooperheat, Inc.
1021 Centennial Avenue
Piscataway, NJ 08854
(800) 526-4233

IHS-Inductoheat
5009 Rondo Drive
Fort Worth, TX 76106
(800) 486-5577

Inductoheat
32251 N. Avis Dr
Madison Heights, MI 48071
(810) 585-9393

Inductotherm Corporation
10 Indel Avenue
Rancocas, NJ 08073
(800) 257-9527

Pillar Industries
N92 W 15800 Megal Dr
Menomonee Falls, WI 53501
(800) 558-7733

Taylor-Winfield
P.O. Box 500
Brookfield, OH 44403-0500
(216) 448-4464

Thermatool Corporation
31 Commerce Street
East Haven, CT 06512
(203) 468-4100

TOCCO, Inc.
30100 Stephenson Highway
Madison Heights, MI 48071
(810) 399-8601

This list of vendors of the indicated technology is not meant to be a complete or comprehensive listing. Mention of any product, process, service, or vendor in this publication is solely for educational purposes and should not be regarded as an endorsement by the authors or publishers.

Index to EPRI DOCUMENTS

Induction Melting

Induction Melting, EPRI CMP TechCommentary, CMP-072, 1991

Induction Melting for a Competitive Advantage, EPRI CMP TechApplication, CMP-048, 1990

Induction Melting for Pollution Elimination, EPRI CMP TechApplication, CMP-1289-010, 1989

Induction Melting for Profit-Improving, EPRI CMP TechApplication, CMP-0689-016, 1989

Induction Melting for Business Building, EPRI CMP TechApplication, CMP-1289-020, 1989

Induction Melting for Operating Flexibility, EPRI CMP TechApplication, CMP-1289-021, 1989

Induction Heating Billets for Forging, EPRI CMF TechApplication, Vol 1, No 20, 1987

Induction Through Heating for Forging, EPRI CMF TechApplication, Vol 1, No 7, 1991

Vacuum Induction Melting Technology, EPRI CMP TechCommentary, Vol 3, No 3, 1987

Induction Heating, EPRI CMP TechApplication, CMP-0689-015, 1988

Induction Melting for Higher Productivity, EPRI CMP TechApplication, CMP-1188-018, 1988

Electromagnetic Stirring for Aluminum Melting, EPRI CMP TechApplication, CMP-101, 1995

Transverse Flux Induction Heating of Continuous Caster Belts for Producing Aluminum Strip, EPRI CMP TechApplication, CMP-102, 1995

Induction Heating for Textile Printing and Embossing, EPRI Textile Office TechApplication, No 1, 1995

Induction Heat Treatment

Induction Heat Treatment, EPRI CMF TechCommentary, Vol 2, No 2, 1990

Induction Hardening with a Flux Field Concentrator, EPRI CMF TechApplication, Vol 1, No 11, 1991

Post-Grinding Induction Hardening, EPRI CMF TechApplication, Vol 1, No 2, 1987

Induction Heating Technology, EPRI CMF TechCommentary, Vol 2, No 1R, 1993

Selective Induction Heat Treatment, EPRI CMF TechCommentary, Vol 2, No 3, 1991

Induction Tempering, EPRI CMF TechCommentary, Vol 2, No 4, 1991

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Induction Susceptor Furnaces, EPRI CMF TechApplication, Vol 2, No 2, 1988

Induction Bonding

Induction Bonding Metal to Plastic, EPRI CMF TechApplication, Vol 2, No 3, 1988

Induction Heating of Thermoset Adhesives, EPRI CMF TechApplication, Vol 1, No 12, 1987

Production of Galvannealed Steel by Induction Heating, EPRI TechApplication, TA-106245 (CMP107), 1996

Most of the above references are copyrighted and are available from the Electric Power Research Institute at a nominal cost.
Call 1-800-432-0267.

This information is designed to help you determine **potential** applications for the technology. You are encouraged to contact one of the listed vendors or a consultant for details and pricing.

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